# VARIABLE RESISTANCE EXERCISE DEVICE

## RELATED APPLICATIONS

**[0001]** The United States patent application serial number 10/278,450 of Gordon L. Brown, Jr. filed October 23, 2002 for an Abdominal Exercise Routine Using A Flexible Elongated Device discloses exercise routines for which this invention is particularly useful.

## FIELD OF INVENTION

**[0002]** The disclosed invention relates to an apparatus designed to perform exercises intended to firm, strengthen and tone a person's abdominal muscles, arm muscles and other muscles of the body when the apparatus is bent, which creates a resistance for the targeted muscles. The disclosed apparatus defines a flexible elongated device which is easy for an individual to handle in that it bends in any direction in response to the forces applied to the ends of the device, or to the center of the device with the hands holding the ends, or to the ends of the device with the hand or hands positioned at or near the center of the apparatus. Also, as the apparatus bends the external shape of the apparatus changes slightly to an oval shape such that as the flat part of the oval contacts a body component, such as the thigh, a greater degree of comfort will be felt by the user.

## BRIEF SUMMARY OF THE INVENTION

**[0003]** It is a principal object of this invention to provide an elongated variable resistant flexible exercise device that is easy to assemble and which bends in any direction when performing exercises, the exercise device preferably includes a flexible tube having rounded interior in which an elongated rod with a rectangular cross section is inserted. When the exercise device is held by the user's hands at or near the ends of the device or positioned on a modified piece of exercise equipment, such as an 'ParaBody 900 ST abdominal contractor', and a force is

applied to the ends of the device, or to the center of the device, the device will readily bend in the intended direction as increased resistance is provided, as the distance between the ends of the device is reduced, with a resulting enhancement of the strengthening, conditioning and toning of the targeted muscles.

**[0004]** It is an additional objective to provide for a greater degree of comfort to the user by having the exterior of the flexible elongated device deform slightly to an oval shape when bent such that the flat part of the oval shape spreads the resistance forces over a wider area of contact with the user's body producing a more comfortable feeling. This feature is due to the use of a flexible extruded thermoplastic tube having an essentially round section cavity into which the pultruded rod loosely fits such that when the thermoplastic tube bends its shape is altered to an oval.

**[0005]** A preferred embodiment features an extruded thermoplastic tubular component such as extruded PVC or a thermoplastic rubber tube that has a round or nearly round section cavity. The thermoplastic tube has a durometer such that the exercise device feels comfortable when placed onto the surface of a person's body such as the front of the person's thigh. It should not be too hard but can be somewhat hard given the fact that the thermoplastic tubular device will deform to an approximate oval cross sectional shape when bent. Into the cavity of the tube there is inserted a pultruded rod having, preferably, a consistent rectangular cross-section shape extending substantially the length of the extruded thermoplastic round tube. The rod fits easily into the cavity of the extruded thermoplastic round tube and is able to rotate freely about its longitudinal axis when inside the cavity of the straight extruded thermoplastic tube. End caps are placed on each end of the tube. When the tube is bent the rectangular section rod will automatically orient itself to bend about its major cross section axis.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0006]** The invention is illustrated in the accompanying drawings, in which:

Figure 1 shows an individual performing an exercise routine using a flexible exercise device;

Figure 2 is a side view of the exercise device;

Figure 3 is a longitudinal section of the exercise device of Figure 2;

Figure 4 is a section taken on line 4-4 in Figure 2;

Figure 5 is an enlarged section of a pultruded rectangular cross section rod.

Figure 6 is a section similar to Figure 4 showing an embodiment of the invention having rectangular section rods in the hollow tube of the exercise device;

Figure 7 is a section of an embodiment of the exercise device without a soft outer sleeve and having four rectangular cross section rods in a hollow tube; and

Figure 8 is a longitudinal section showing the device of Figure 7 bent as occurs in an exercise routine;

Figure 9 is a section taken on line 9-9 in Figure 8; and

Figure 10 is a section showing a round rod and a rectangular cross section rod in a hollow tube.

## DETAILED DESCRIPTION OF THE INVENTION

**[0007]** The invention is hereinafter described in detail by reference to the accompanying drawings. The invention is not intended to be limited to the embodiments described; rather, this detailed description is included to enable any person skilled in the art to produce a flexible elongated exercise device which will bend in any direction when each end is grasped by the user

at or near each end with a force applied to each end of the device; or with the hands grasping each end and applying a force to each end with the center of the device pressed against a part of the body such as the thigh(s); or with the hand or hands positioned at or near the center of the device and the hands applying a force at or near the center of the device with the ends of the device positioned in contact with each of the thighs slightly above the knee.

**[0008]** A preferred embodiment of the flexible exercise device 11, shown in Figures 1 – 5, includes a soft foam plastic tubular sleeve 12, a cylindrical tube 13 and an elongated substantially rectangular section pultruded composite rod 14. The rod 14 is preferably made from a group of mixtures including a mixture of thermoplastic resin and longitudinally oriented continuous glass fiber filaments and a mixture of thermoset resin and longitudinally oriented continuous glass fiber filaments. The rod 14 is designed to be bent into the shape of a semi-circle a minimum of 10,000 times without substantial cracking of the elongated rectangular shape. A material having low hysteresis is preferred for consistency. Suitable end closures, such as plastic caps 16, are installed on the ends of the tube 13. A suitable elongated exercise device 11 for many exercise routines will be about 36 inches in length with an outside diameter of about 1 5/16 inches. A pultruded composite rod 14 for such a device will have dimensions of 0.1875 inch x .500 inch x 35 ¾ inches with the full radius edges 17 over the length of the pultruded composite rod 14. The exercise device has a wide range of application and may be 18 to 72 inches in length and from one half to 3 inches in diameter. The rod 14 has a major axis 21 and a minor axis 22 and may be constructed using PPG Industries, Inc. of Shelby, NC "E-glass" continuous fibers with the resin matrix being a vinyl ester resin. The fiber content is preferably 25% to 70% of the volume of the rod. The resin could alternatively be an epoxy resin, isophthalic polyester, PVC plastisol or other resin selected to give an acceptable flexural

modulus and flexural fatigue performance in bending as well as minimal creep. A suitable composite rod is made by Glasforms, Inc. of San Diego, CA. The soft, one piece smooth surface foam sleeve 12, available from Hunt-Wilde Corp. of Tampa, Florida, is slid over the outside of the extruded flexible PVC annular section tube 13 to cover substantially the full length of the extruded flexible PVC thermoplastic round tube 13 to give the exterior of the device 11 a soft feel against the individual's legs, thighs and hands. The extruded flexible PVC round tube 13, with a durometer of approximately 92 as measured on the Shore A scale, is made by Agricultural Products, Inc. of Ontario, California. The rod 14 provides variable resistance as the exercise device is bent. The pultruded composite rod 14 is inserted into the essentially cylindrical cavity of the extruded flexible PVC thermoplastic tube 13 defined by a radially inward facing cylindrical surface 15. The pultruded rectangular cross section rod 14 is easily inserted into the cavity of the tube 13 without deforming the shape of the tube 13 and removable PVC end caps 16 from Harman Corporation of Rochester, Michigan are placed over the ends of the tube 13. The caps 16 may be secured, as by an adhesive, if desired. The rod 14 is no longer than the tube 13.

**[0009]** If an exercise device requiring greater bending force is desired an additional rod 14 may be inserted in the tube 13 as shown in Figure 6. When the tube 13 is bent, both of the rods will orient themselves to bend about their major cross sectional axes. Friction between the rods 14 during bending may be reduced by inserting a 1 to 6 millimeter thick polyethylene thermoplastic strip 18 between the rods 14. The interleaved strip 18 may be slightly wider and as long as the rods 14.

**[0010]** An alternative exercise device 31, shown in Figures 7, 8 and 9, has a larger outside diameter extruded flexible PVC thermoplastic tube 32 than the extruded flexible PVC

thermoplastic tube 13 shown in Figures 2, 3, 4 and 6. The inside diameter of the alternate exercise device 31 can be tailored to accommodate a wider range of sizes of rectangular cross section rods than are accommodated in the extruded flexible thermoplastic tube 13. The tube 32 has a surface hardness in the range of 50 to 100 as measured by the Shore A scale. Four pultruded rectangular cross section rods 34 are inserted in the tube 32 of the alternative exercise device 31. Closures in the form of end caps 36 are then installed on the ends of the tube 32. The rods 34 are thinner in the direction of their minor axis than the rods 14 and have a greater flexural endurance than the rods 14.

**[0011]** Figure 10 shows a rectangular cross section rod 46 and a round cross section rod 47 fitting loosely in a flexible PVC thermoplastic tube 48. The round cross section rod 47 may be added when a slightly stiffer exercise device 45 is desired.

**[0012]** When the complete device is bent by the hands applying a force at or near each end of the device, the extruded PVC thermoplastic tube 13, 32 or 48 deforms as shown in Figure 8 without kinking and with the pultruded composite rod, or rods, orienting itself, or themselves during the initial phase of the bending in response to forces exerted on the lengthwise edges by the interior cavity surface of the extruded flexible PVC thermoplastic round tube as its mid section deforms slightly to an oval section as shown in Figure 9 such that the pultruded composite rod or rods and the tube of the exercise device bend readily in the direction that the device is bent in response to the forces exerted on the ends of the device by the hands. In the bending exercise of the device 11, 31 or 45, the pultruded composite rod or rods will orient itself or themselves to bend about its axis or major axis 21 which is approximately parallel to the major axis 41 of the oval section shape of the deformed tube 32 as shown in Figure 9.

**[0013]** Prior to insertion of the pultruded composite rod into the cavity of the tube, the rod may have a wax, such as carnauba wax, applied to its surface which allows the rod to move easier inside the cavity of the tube as the rod orients itself so it can bend around its major axis as the tube is bent by the application of forces at or near each end of the exercise device. Further, a lubricant spray, such as WD-40, may be sprayed into the cavity of the tube, instead of applying the carnauba wax to the pultruded rod, prior to or after insertion of the rod in the cavity and before the application of the end caps to permit the pultruded bar to move easier inside the cavity of the tube as the rod orients itself so it can bend around its major axis upon the application of bending forces to the exercise device.

**[0014]** The pultruded rectangular cross section rods 14 and 34 will automatically orient themselves in the tube by bending about their major cross sectional axes during the initial bending of the exercise device. The extruded flexible tube's material density and surface hardness can be varied as long as the extruded tubular shape does not kink when bent at least into the shape of a semi-circle or interfere with the pultruded rod's natural tendency to orient itself to bend around it's major cross sectional axis. Even when multiple rods are used, as shown in Figures 6 and 7, the rods will orient themselves to bend about their major cross sectional axes as the exercise device is bent during an exercise routine. The use of a plurality of thin rods 34 allows the exercise device to be tailored to individual requirements. A slight increase in bending resistance can easily be achieved by the addition of one or more small diameter rods 47. The addition of small diameter rods 47 does not prevent the rectangular cross section rods from orienting themselves to bend about their major axes.

**[0015]** There are additional advantages flowing from use of a plurality of relatively thin rectangular cross section rods. A thin rectangular cross section rod has a longer service life than

a thick rectangular cross section rod and the use of a plurality of thin rectangular cross section rods make it easy to select the number of rods to match the stiffness desired or to change the stiffness for any reason during use.